First steps toward the establishment of a Nitrogen Cycling network in Latin America (Nnet)

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Nitrogen Cycling In Latin America: Drivers, Impacts And Vulnerabilities (Nnet)

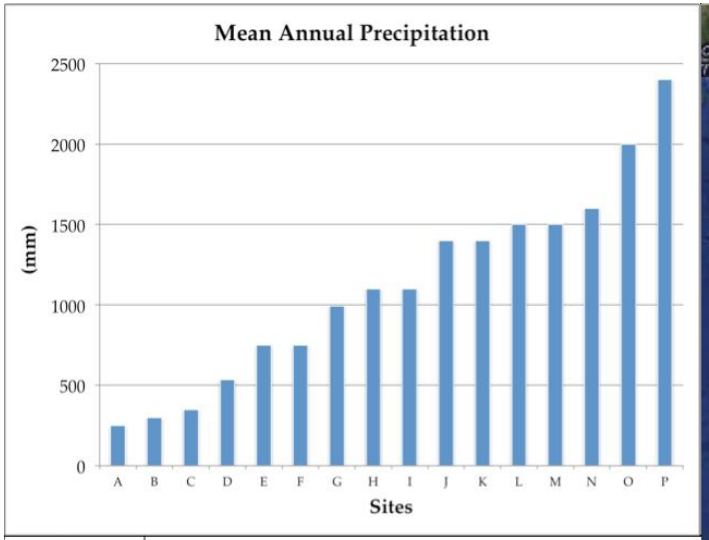
- Why? The lack of information on the nitrogen cycle in Latin America is a serious impediment to our ability to evaluate and project how human activity is altering nitrogen pools and turnover at regional and global scales.
- General Objective: develop a broad integrative network of research and outreach across multiple ecoregions and socioeconomic backgrounds in Latin America

Conceptual approach

- **Dynamics of Biological N fixation**: Reduce the uncertainty associated to the quantification of N input to terrestrial and aquatic systems in the studied regions
- **N dynamics and ecological processes**: Studies of N cycle dynamics and associated ecological processes in terrestrial and aquatic ecosystems.
- **N deposition** : Determination of atmospheric N sinks by measuring wet and dry deposition.
- **Modeling the atmospheric component of N cycle:** Studies of the main atmospheric chemistry and transport processes related to the N cycle aiming to contribute to the development of an atmospheric model suitable to consistently integrate the observations of N fluxes.
- **Training and Education activities:** Training of 10 to 15 students during the project.
- **Expert elicitation – Social/Policy context:** build relationships with other stakeholders (e.g. economists, government, etc.)

Geographical distribution of all sites

Measurements of BNF, N dynamics, dry and wet deposition



Site	Ecosystem
A	**Alpine**
B	Sclerophyllous savanna
C	**Alpine**
D	Caatinga
E	Chaco dry savannas and woodlands
F	Tropical dry forest
G	Altos de Pipe
H	Transition tropical forest-dry tropical forest
I	Cerrado / savannas and gallery forests
J	Pantanal
K	La Iguana
L	Mata Atlântica
M	**Alpine**
N	Wet tropical forest
O	Transition tropical forest-dry tropical forest
P	Mata Atlantica

Wet and dry deposition

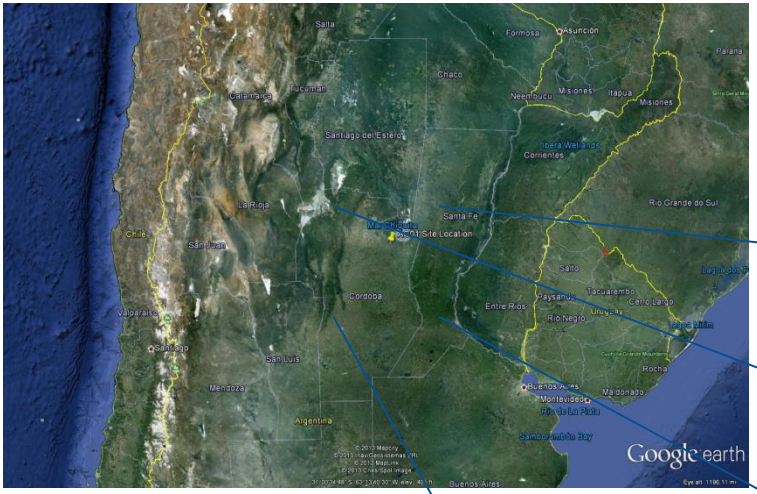
- Rainfall sampling will be conducted following procedure described in the GAW manual
- Gas and particle sampling will be accomplished using a denuder based system to estimate dry deposition
- Samples will be collected on a weekly basis
- Analytes: nitrate, ammonium, chloride, phosphate, sulfate, proton, sodium, potassium, magnesium, and calcium.
- The analysis will be performed initially in three laboratories simultaneously allowing the South American protocols to be qualified against an already well-established one (Illinois Water Survey, NADP)

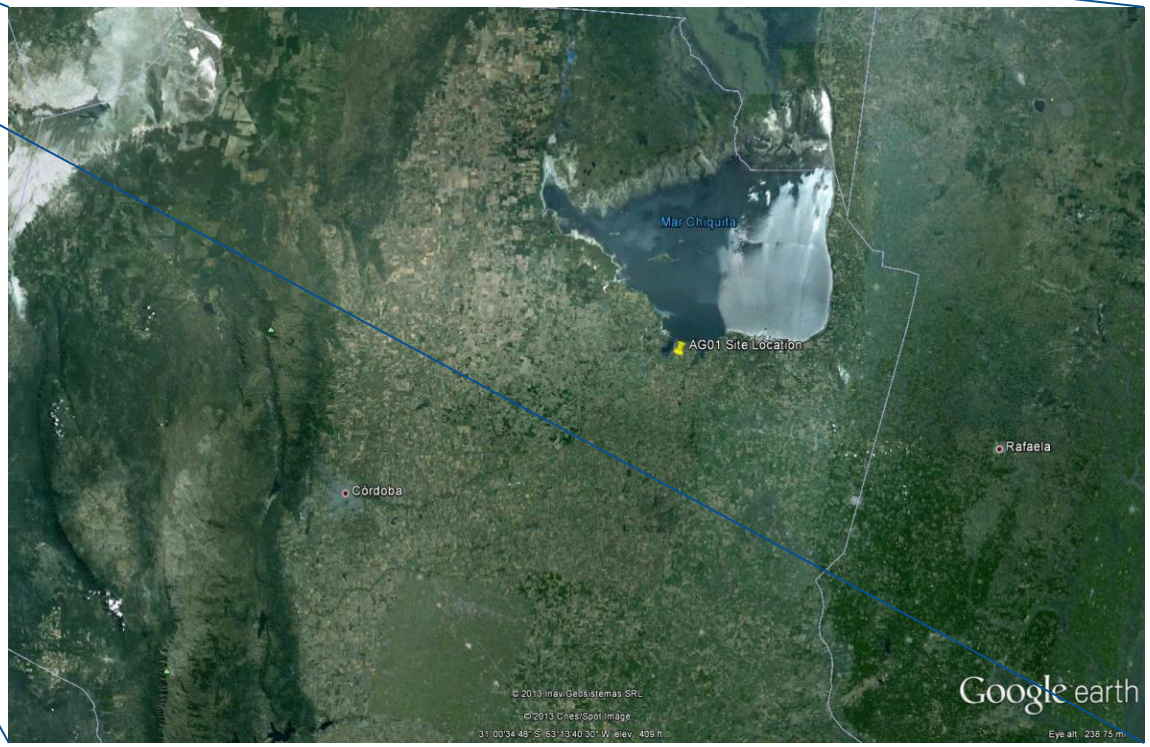
Initial wet and dry deposition sites

- Number of sites planned for first year: 3
- Locations: Mar Chiquita (Argentina) **(E)**, La Iguana (Venezuela) **(G)** and Cachoeira Paulista (Brazil) **(L)**.
- Sites will use NADP approved collectors
- Currently the site in Argentina is operational for wet deposition only.

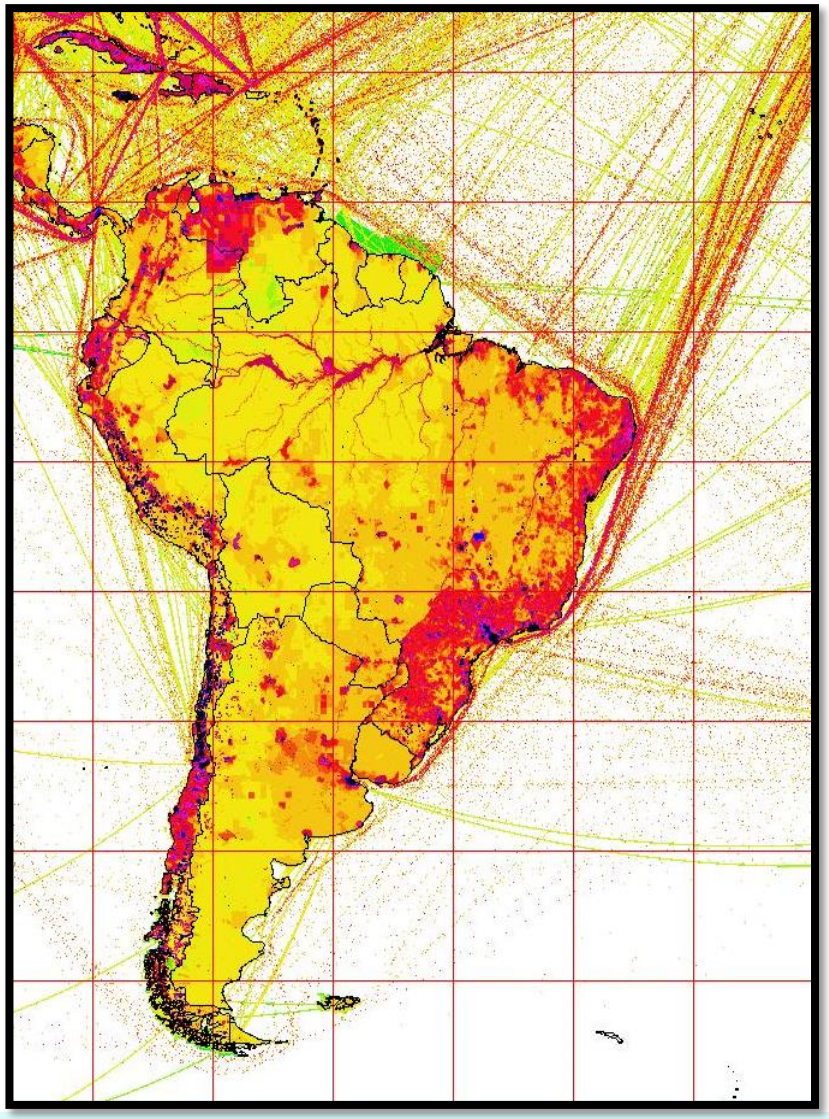
- Argentina site:
  - Follows NADP sampling protocol
  - Chemical analysis at CAL, Illinois Water Survey
  - Aerochem Metrics colector and Belfort rain gauge (state-of-the-art) ☺

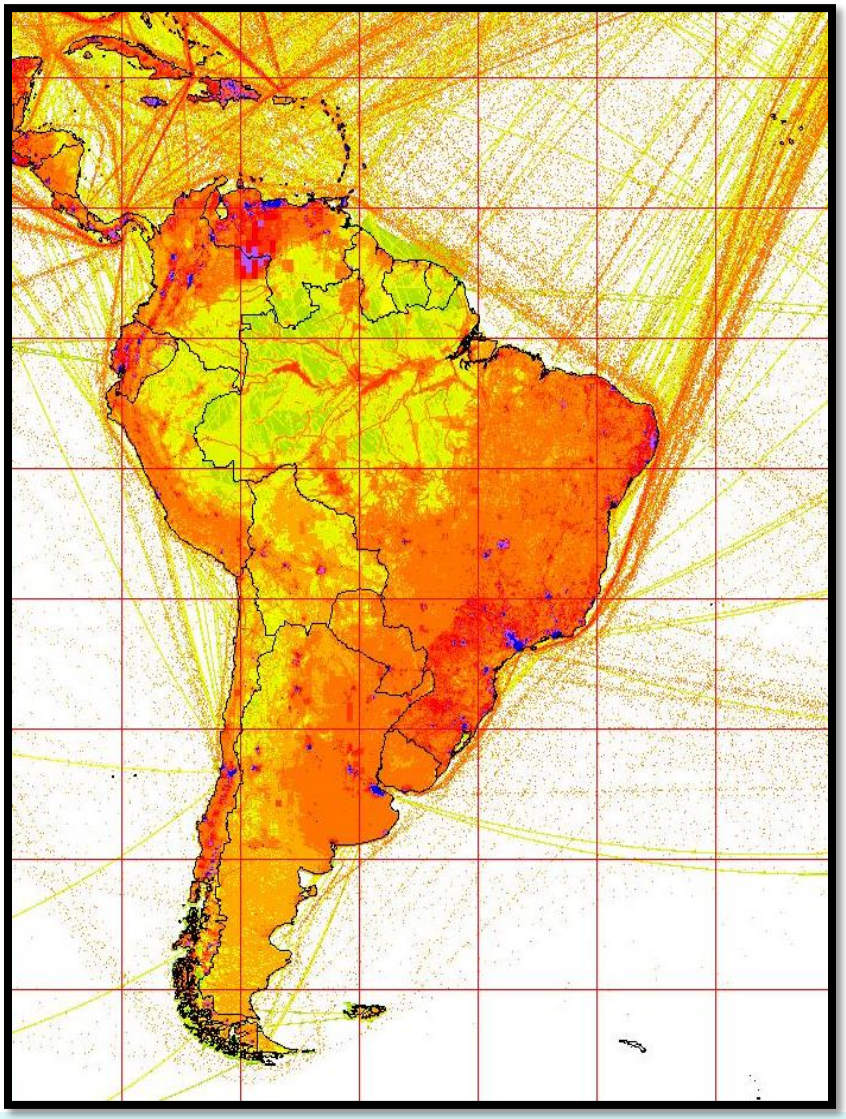
AG01: Geographical Location



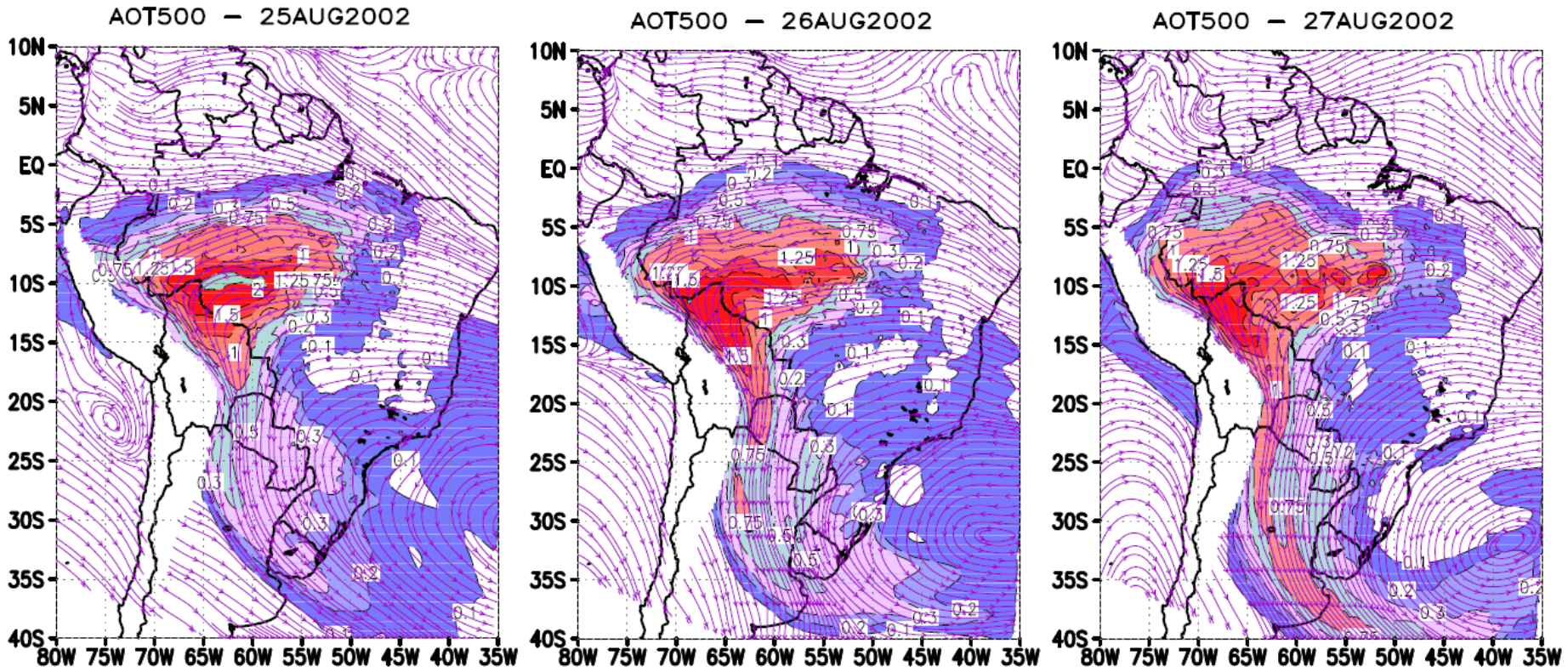


Sulfur dioxide and Nitrogen oxides emissions (EDGAR)





Forest fires



Ana Graciela Ulke, Karla María Longo and Saulo Ribeiro de Freitas (2011). Biomass Burning in South America: Transport Patterns and Impacts, Biomass - Detection, Production and Usage, Dr. Darko Matovic (Ed.), ISBN: 978-953-307-492-4, InTech, DOI: 10.5772/19264. Available from: http://www.intechopen.com/books/biomass-detection-production-and-usage/biomass-burning-in-south-america-transport-patterns-and-impacts

Salt storms

Before the site was established

The site now


MAR CHIQUITA WET DEPOSITION MONITORING STATION
Estación de Monitoreo de Deposición Pluvial en Mar Chiquita
(Ag01)


MAR CHIQUITA WET DEPOSITION MONITORING STATION
Estación de Monitoreo de Deposición Pluvial en Mar Chiquita
(Ag01)
National Atmospheric Deposition Program (USA)
World Meteorological Organization (WMO)
National Oceanic and Atmospheric Administration (USA)
PROMAR Universidad Nacional de Córdoba
Fundación MAR (Marull)
El Sr. Carlos Laurenti facilita el desarrollo de este proyecto en su propiedad

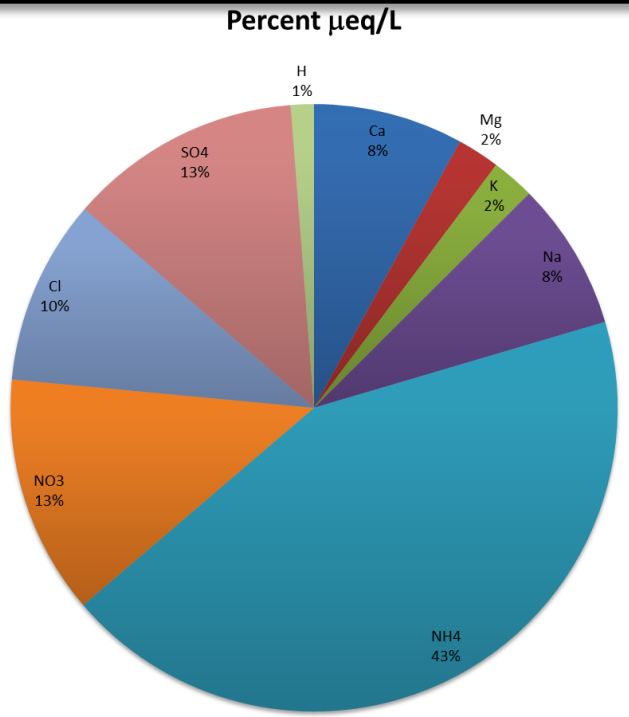
Some challenges setting up the site

- Ink will dry up under very hot summer conditions.
- Sensor not working properly. Collector will open and close during rain event. Replaced 3 sensors!!
- Lots and lots and lots of paperwork needed to import supplies to Argentina.
- Very expensive to ship buckets to be cleaned at Central Lab

Some solutions

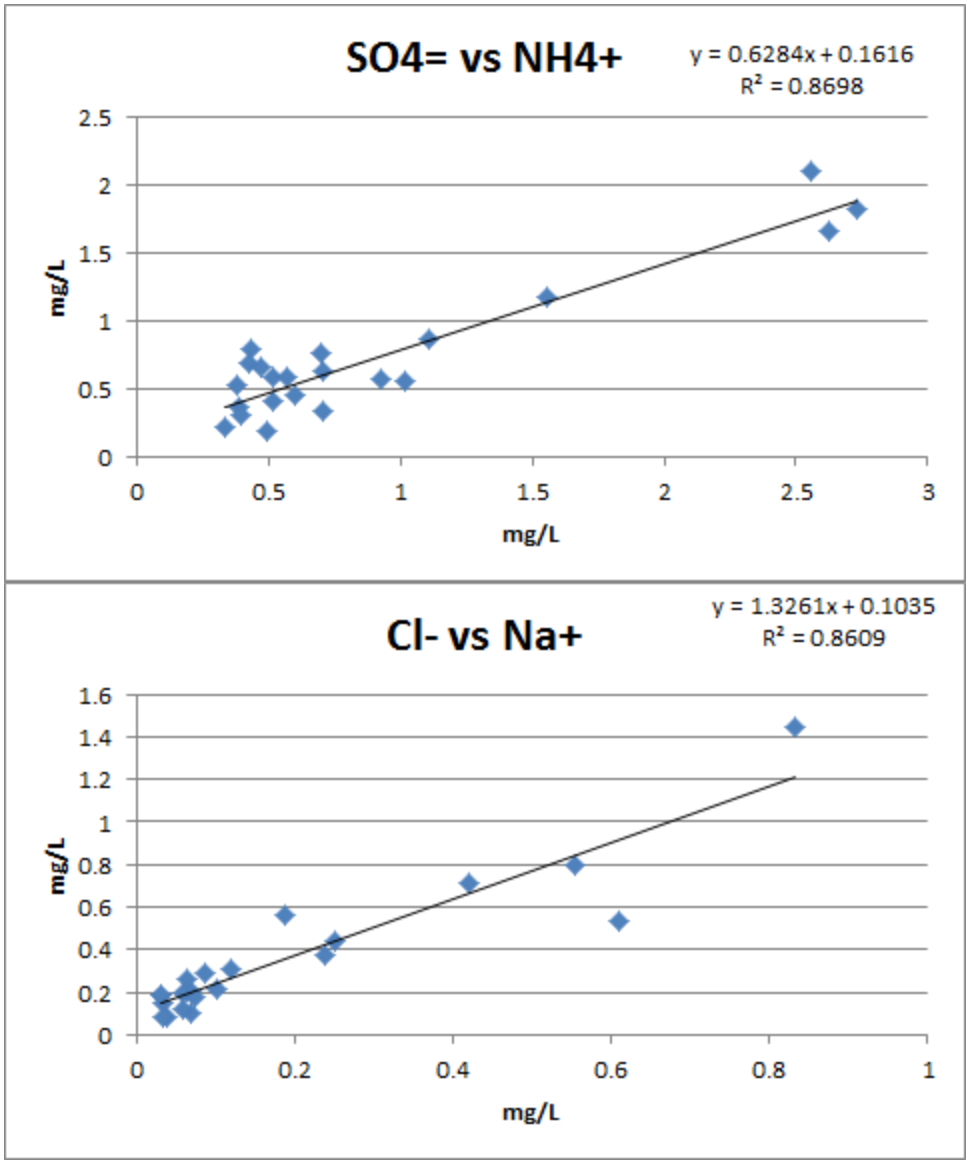
Annual average composition 2012

mass concentration	Ca	Mg	K	Na	NH4	NO3	Cl	SO4
mg/L	0.132	0.023	0.074	0.150	0.644	0.652	0.289	0.492



ID	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH
UT01 2009	0.3	0.031	0.021	0.301	0.655	0.717	0.438	0.409	6.27
UT01 2010	0.246	0.028	0.016	0.194	0.585	0.582	0.314	0.291	6.21
UT01 2011	0.313	0.035	0.022	0.265	0.514	0.468	0.369	0.392	6.17

Some relationships between analytes



Deposition 2012

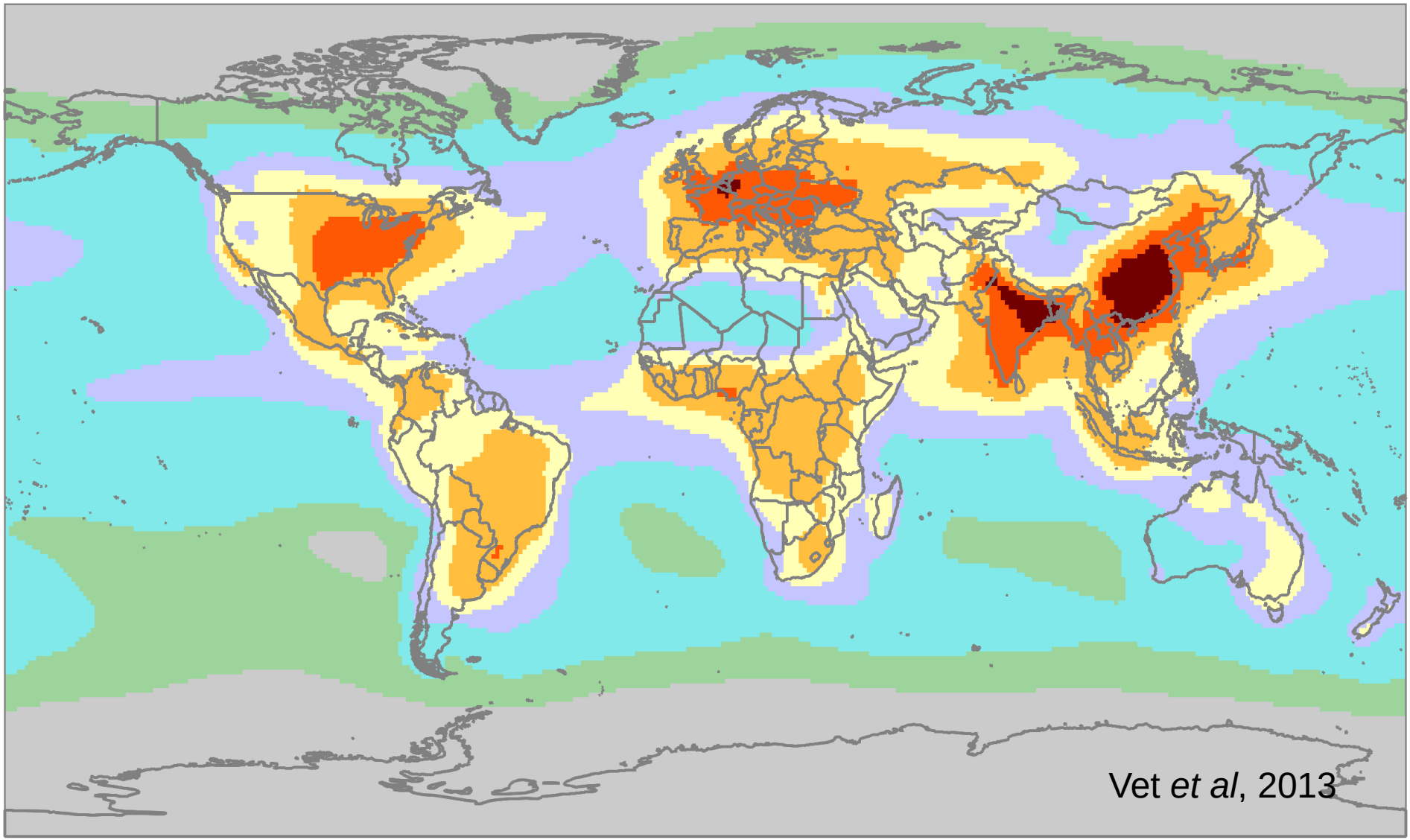
kg/ha/yr	Ca	Mg	K	Na	NH4	NO3	Cl	SO4
mass deposition	0.85	0.15	0.48	0.97	4.16	4.22	1.87	3.42

Other sites in Argentina and Uruguay (bulk measurements)

Kg/ha/yr	Ca	Mg	K	Na	NH4	NO3	Cl	SO4
Rocha	1.94	2.12	1.32	15.93	4.18	1.9	61.2	2.36
Mariscala	1.97	0.36	0.55	3.24	2.14	1.28	6.37	2.35
Montevideo	3.92	1.08	3.04	7.18	4.27	1.84	15.85	1.88
Buenos Aires	4.25	0.68	2.58	6.14	6.32	2.82	6.1	5.01
Pergamino	1.95	0.52	2.22	9.12	3.92	1.85	4.14	2.49

Gervasio Piñero, 2013

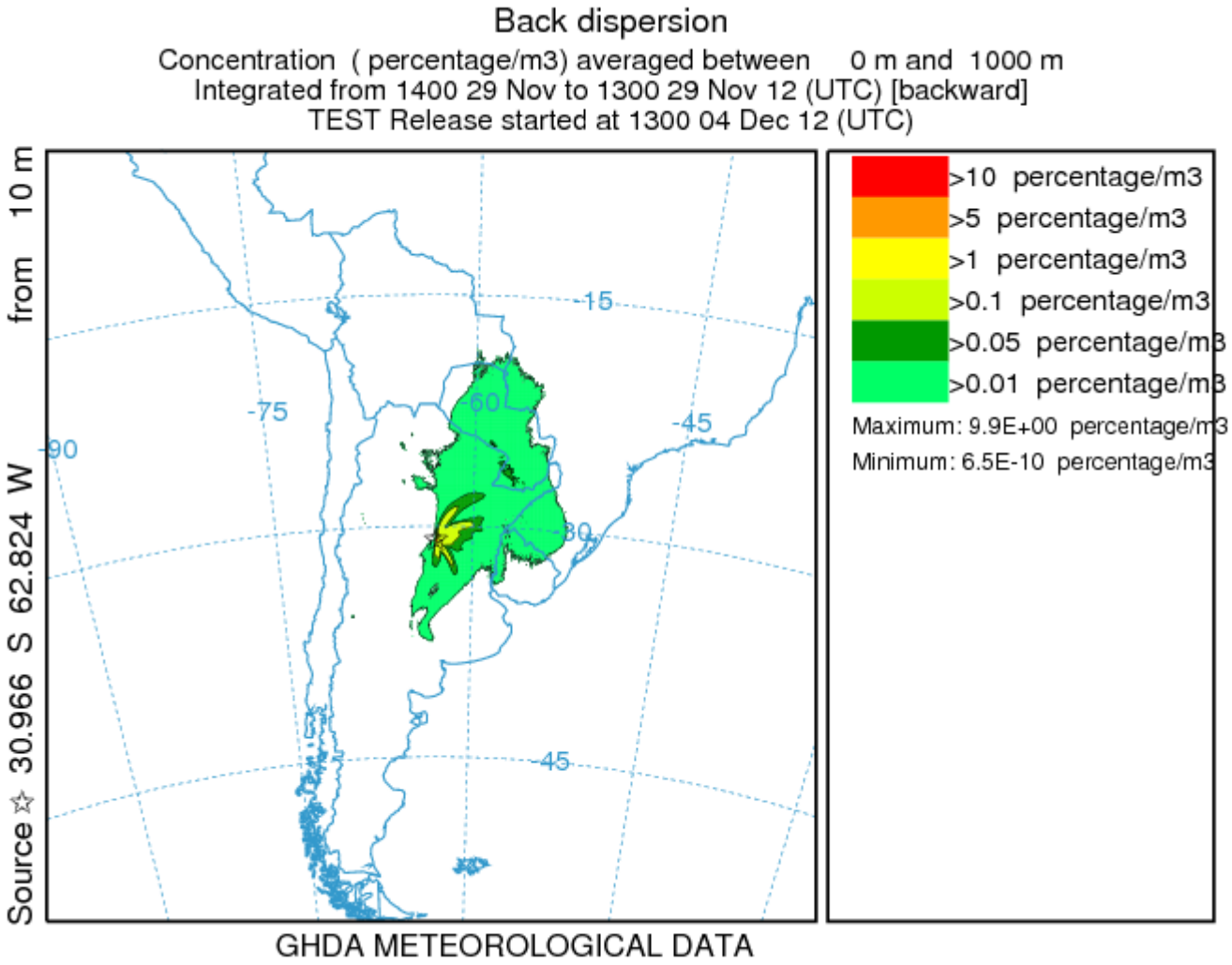
2001 HTAP ensemble mean model



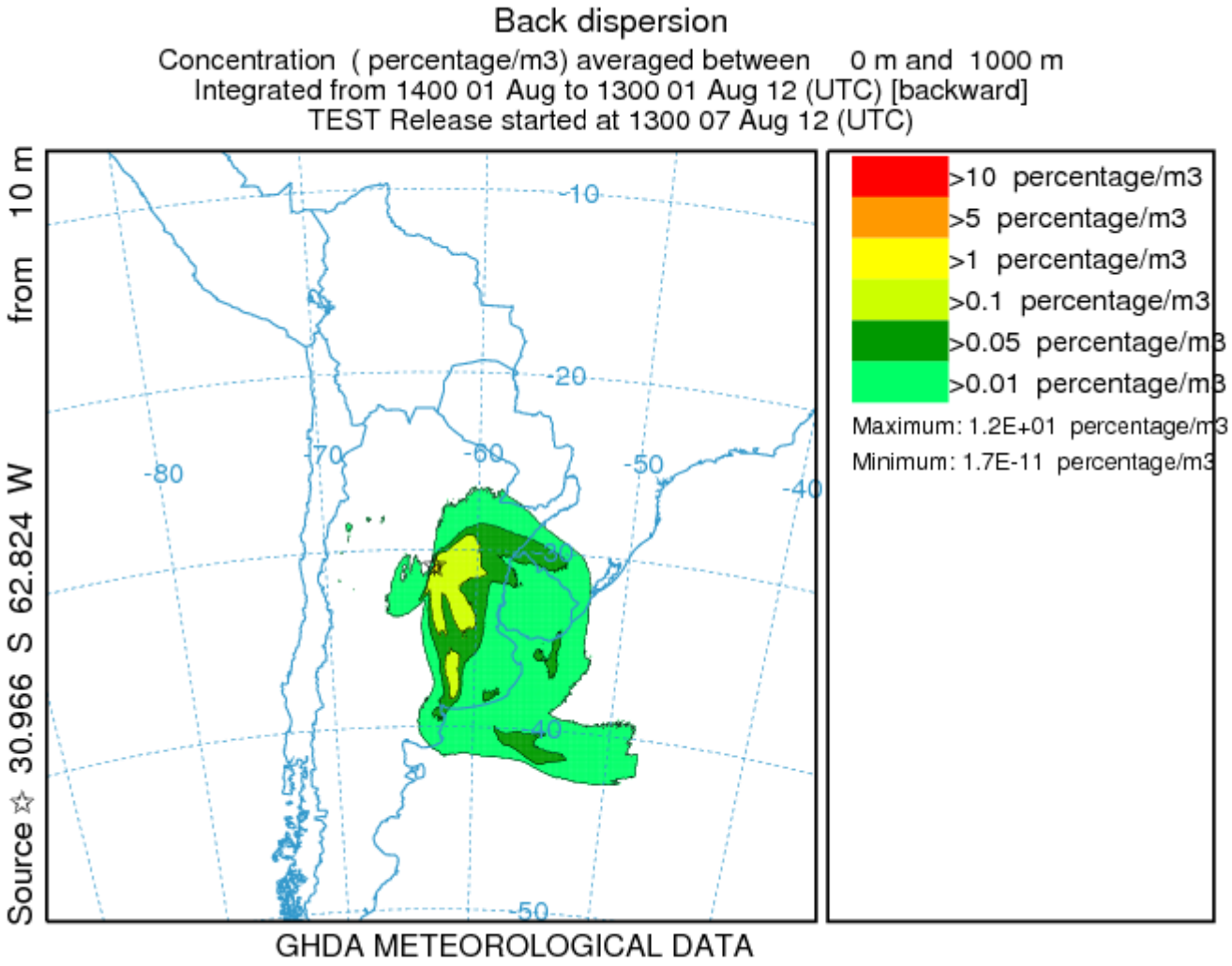
Deposition : Wet+Dry $N_{reduced}$ + $N_{oxidized}$ [kg N ha^{-1} a^{-1}]

0 | 0.2 | 0.4 | 1 | 2 | 4 | 10 | 20 | 40

Back dispersion – Dec 04, 2012
N dominated deposition



Back dispersion – Aug 07, 2012
S dominated deposition



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